



RESTRICTED CIRCULATION

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AGRICULTURAL MEMORANDUM NO. 856

SHELTER FOR LAMBING IN A PENNINE VALLEY - II
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1. BACKGROUND TO THE WORK

Studies of the economics of hill sheep flocks have shown that lamb deaths are an important cause of financial loss. An experiment began in the Spring of 1978 at Great House Experimental Husbandry Farm, to study the behaviour of ewes at lambing and the causes of lamb deaths. Agricultural Memorandum No. 846 describes the meteorological aspects of this first phase of the work and how, in particular, patterns of air flow were seen to develop over the field, known as Stone Law, winds from a particular quarter producing sensibly the same pattern of flow. During the second phase of the experiment in the Spring of 1979, it was therefore deemed necessary to measure at only one place in the field to infer the pattern of air flow over the field from the measurements made in phase I.

Lambing was timed to occur 3 weeks earlier than in phase I on the assumption that the stock would have to contend with harsher weather.

In the event the low temperatures and the long period of snow cover at Great House resulted in an insufficient growth of grass on Stone Law to support the ewes over the lambing period. Hand feeding was ruled out on the grounds that placing of the feed would modify the behaviour of the ewes. Further, the likelihood of damage due to poaching led to this second phase having to be postponed until the Spring of 1980.

Wind and temperature measurements were, however, made on Stone Law during the period 26 February to 19 April 1979, and these are here analysed. The extrapolation technique described above is demonstrated during detailed analysis of weather stress of the 7 and 10 of March.

2. EQUIPMENT

A Woelfle type wind speed and direction recorder was installed at the weather station together with a bimetallic thermograph mounted in a Stevenson Screen adjacent to the existing thermometer screen.

Another screen also containing a bimetallic thermograph was installed at a height of 0.5 m and 0.5 m away from the NE boundary wall at the position shown in Fig. 1. At this point a grass minimum thermometer was installed.

3. ANALYSIS OF WIND DATA

Wind directions for the times 00, 06, 12 and 18 hours for all occasions of wind speed greater than 3 kt were extracted from the Woelfle record. These are shown in Fig. 2 plotted against directions of the isobars taken from the appropriate

Daily Weather Report. Surface winds from most directions at Stone Law are backed by an average of 30° from the geostrophic wind direction, but when air flows directly into the valley, from 050° , backing is much reduced.

Further, vertical stability of the air, insofar as it is indicated by the time of day does not seem to have much effect. To demonstrate this, observations for 12 hours are shown as "+" in Fig. 2.

4. TEMPERATURE ANALYSIS

Differences of air temperature measured at 1.1 m at the weather station and at 0.5 m at the NE wall site were generally less than 0.5°C in winds greater than 5 kt.

The lowest air temperatures, recorded early on 4 April during a night of strong radiative cooling were -2.0°C at the NE wall site and -2.6°C at the weather station. The highest temperatures, recorded on the 19 April were 14.5°C at the NE wall site and 12.5°C at the weather station.

Mean minimum air temperatures were 1.2°C at each site, but the mean maximum air temperature at the wall site was 1.1°C higher than that at the weather station.

The greatest air temperature difference occurred on the 18 April, when the maximum of 13.1°C recorded at the wall site was 3.4°C higher than that at the weather station.

The mean grass minimum temperature at the weather station was $+0.4^{\circ}\text{C}$ the lowest minimum being -6.1°C recorded on the 12 March. The highest minimum of 5.5°C was recorded on the 11 April. At the wall site the mean grass minimum was $+1.0^{\circ}\text{C}$ the lowest minimum of -2.9°C being recorded on the 15 March, and the highest of 6.5°C on the 11 April.

5. ANALYSIS OF STRESS ON INDIVIDUAL DAYS - 7 MARCH 1979, FIG. 3 10 MARCH 1979, FIG. 4

The weather of two days with similar rainfall, run of wind (276 miles) and mean temperature ($+2^{\circ}\text{C}$) but with different wind directions, is here analysed.

On the 7 March the wind blew consistently from the 270° - 330° sector, but on the 10th it blew from the 150° - 210° sector. Sector diagrams derived during the Spring of 1978 were used to construct air flow diagrams for each day by extrapolation from the trace produced at the weather station by the Woelfle wind speed and direction recorder by:-

- (a) Reducing the speed measured by the Woelfle at 2 m to the speed appropriate to 1 m, using factors previously derived for each direction.
- (b) Calculating and plotting the speeds appropriate to the original 9 sites on the field.
- (c) Drawing isotachs.

Using Alexander's technique for assessing stress on young lambs it was found that in those parts of the field which experienced a wind run of more than 230 miles per day lambs weighing less than 3 kg would have been unable to maintain their body temperature and would have succumbed. These areas are shown hatched in Figs. 3 and 4 and are seen to differ widely depending on wind direction. Thus with winds from

the 270°-330° sector 3 kg lambs would be at risk over most of the field whereas when the wind was blowing from the 150°-210° sector the 'danger' area was reduced to about one quarter of the area of the field.

CONCLUSIONS AND RECOMMENDATIONS

It is again clear that the role of the walls in reducing wind speed is perhaps worthy of more detailed study.

The diagrams of areas of stress (Figs. 3 and 4) calculated using relationships derived during phase I show that new born lambs of light weight whose coats are wetted by either rain or uncleansed birth fluids are most likely to survive if they are born, and remain, within the shelter of the walls.

Analysis of all wind direction sectors shows that in the usually adverse conditions where hand feeding is necessary it would be prudent, irrespective of the wind direction at the time of placing, to place feed for the adult stock close to the boundary walls to ensure that during feeding at least the young stock, usually attendant upon the ewe, is not exposed to the possibly fatal weather stress in the unprotected parts of the field. Judicious placing of the feed on a day to day basis will be necessary to reduce loss of natural feed due to poaching likely from concentrating the stock near to the walls.

ACKNOWLEDGEMENTS

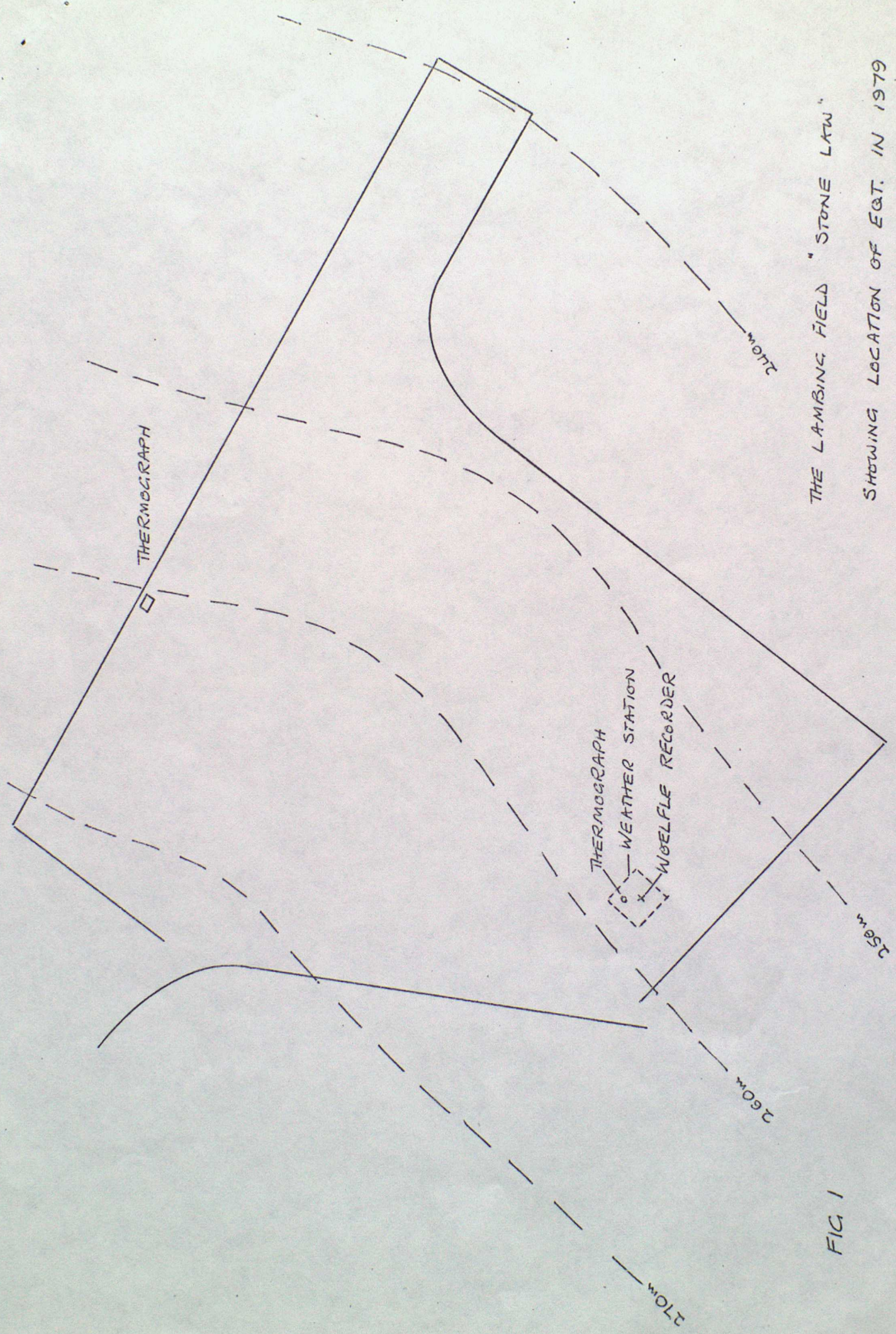
The loan of the Woelfle Wind Recorder by Dr C P E Longden of Broom's Barn Experimental Station, Bury St Edmunds was much appreciated, and thanks are due to Mr H Stamper-Gill the Meteorological Observer at Great House EHF.

Any comments or suggestions about this paper should be referred to the author.

Meteorological Office
Harrogate
June 1979

REFERENCES

1. L G Bird and J B Tyldesley Agricultural Memorandum No. 846
"Shelter for Lambing in a Pennine Valley" (1978)
2. Alexander G Proceedings of the Australian Society of Animal
Production Vol. 5, pp. 113-122.



THE LAMBING FIELD "STONE LAW"
SHOWING LOCATION OF EQT. IN 1979
SCALE 0 30 m

FIG. 1

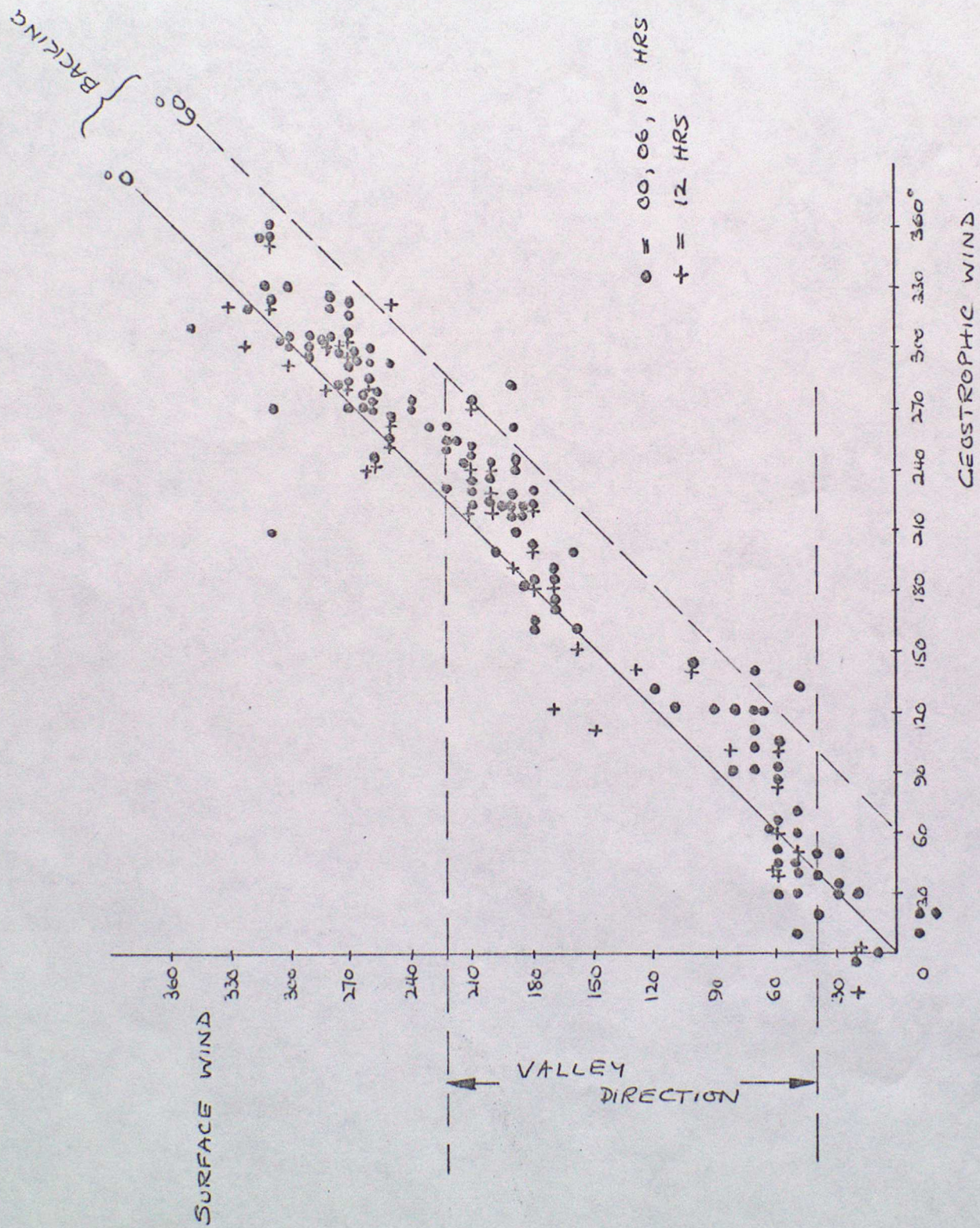
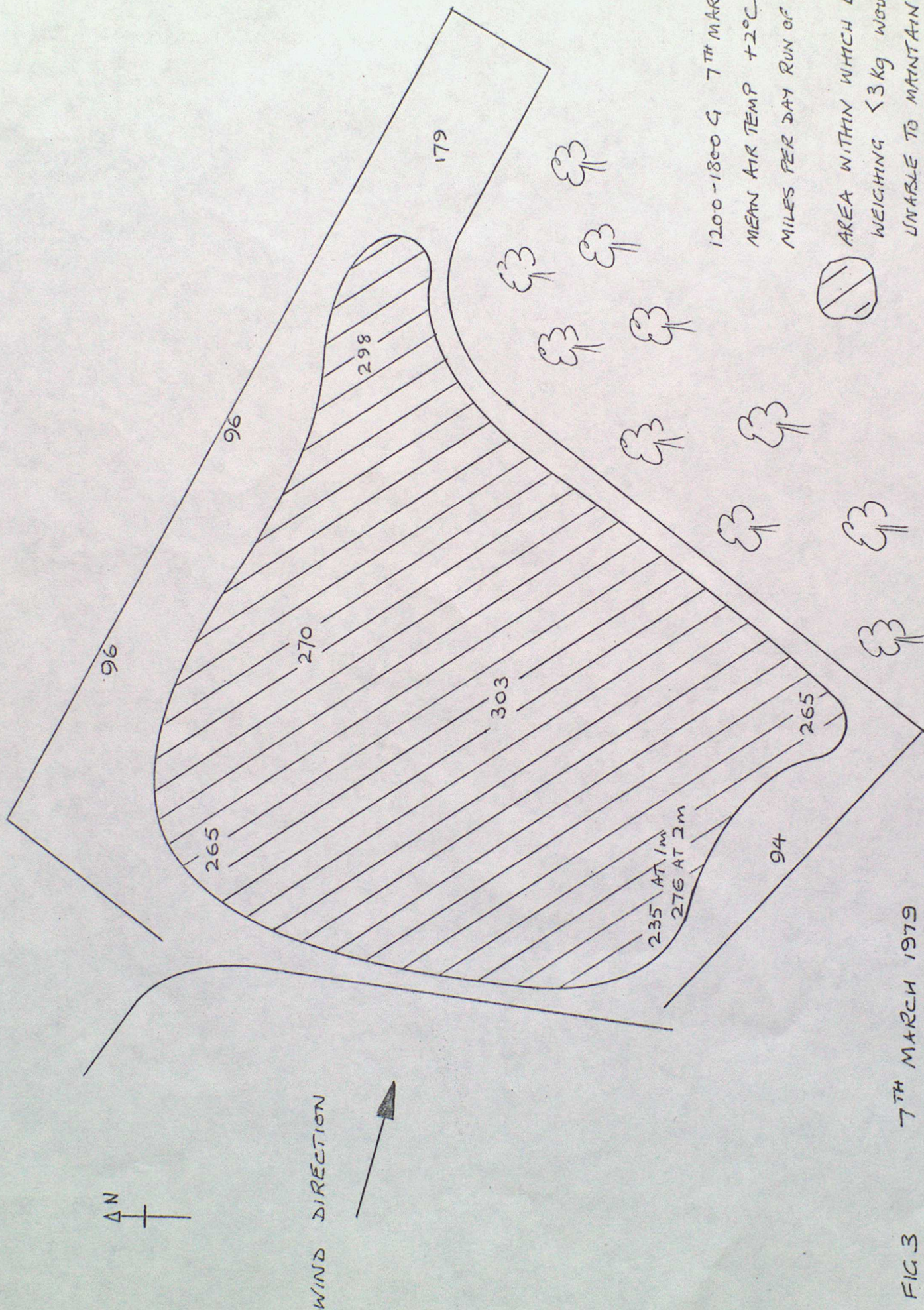


FIG 2
 SHOWING RELATION SURFACE WIND AT STONE LAW
 TO GEOSTROPHIC WIND FROM DWR - SPRING 1979



1200-1800 G 7TH MARCH 1979
 MEAN AIR TEMP +2°C
 MILES PER DAY RUN OF WIND PLOTTED



AREA WITHIN WHICH LAMBS
 WEIGHING <3kg WOULD BE
 UNABLE TO MAINTAIN BODY
 TEMPERATURE

SCALE 0 30 m

FIG 3 7TH MARCH 1979

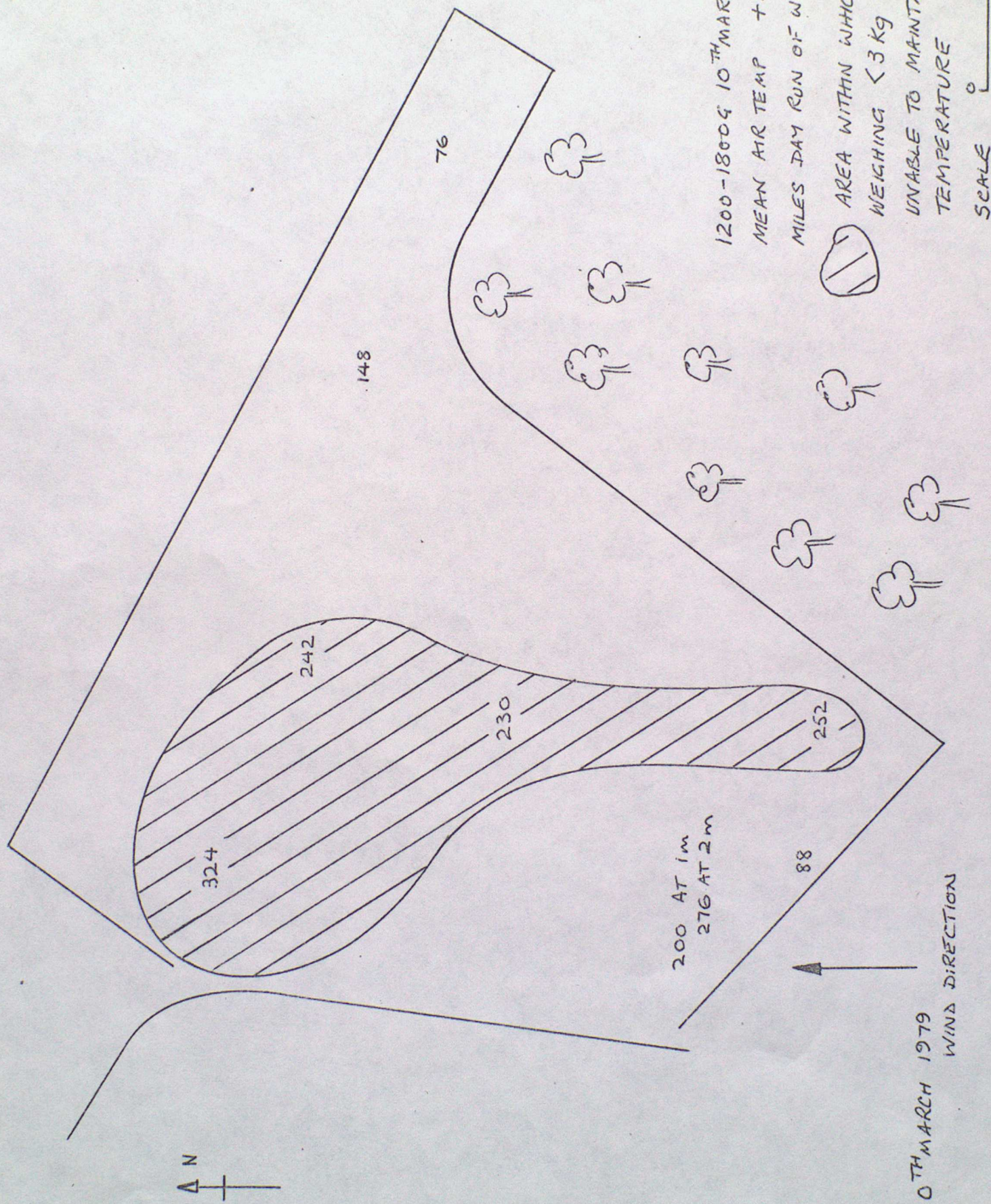


FIG 4 10TH MARCH 1979
 WIND DIRECTION